CLAIMS

1. A method of generating a schedule for operation of a machine forming at least a part of a lithographic apparatus or a lithographic processing cell, the method comprising:

receiving a plurality of weight factors for respective ones of a plurality of qualities affecting the outcome of a lithographic process;

generating an optimum schedule of tasks to be performed to complete said lithographic process, said optimum schedule being one whose outcome has a maximum value of total quality, where total quality is the sum of the products of the values of each of said qualities and the respective weight factors.

2. A method according to claim 1 wherein said schedule specifies an order of tasks to be carried out by said machine and relative timings of at least some of said tasks.

3. A method according to claim 2 wherein said schedule further specifies at least one parameter for at least one task.

4. A method according to claim 1 wherein said weighting factors are defined for a lot of substrates.

5. A method according to claim 1 wherein said qualities are selected from the group comprising:

total post exposure delay time;

variation in post exposure delay time;

the number and/or type of alignment tasks to be carried out;

the degree of optimization of substrate conditioning;

the number, type and or timing of mask cleaning and inspection tasks;

the speed at which a scan is carried out; and

the degree of optimization of the exposure route.

6. A method according to claim 1 wherein said generation of an optimum schedule comprises:

generating a plurality of schedules;

calculating the total quality value for each generated schedule; and

selecting from among said generated schedules the schedule having the highest total quality value.

7. A method according to claim 1 wherein said generation of the optimum schedule is based upon a model of the machine.

8. A device manufacturing method comprising operating one or more tasks in a lithographic projection apparatus according to the method of claim 1 and projecting a patterned beam of radiation onto a target portion of a substrate.

9. A method of operating a machine forming at least a part of a lithographic apparatus or a lithographic processing cell, the method comprising:

providing a model of the machine in an initial state;

determining eligible tasks that can be performed by the machine based on the state of said model;

selecting one or more of said tasks according to at least one predetermined criterion;

adding the one or more selected tasks to a partial schedule;

updating said model to reflect completion of said one or more selected tasks;

detecting whether the machine is idle and if so controlling it to perform said partial schedule; and

repeating said determining, selecting, adding, updating and detecting until all tasks necessary to complete a lithographic process have been scheduled.

10. A method according to claim 9 further comprising receiving a plurality of weight factors for respective ones of a plurality of qualities affecting the outcome of said lithographic process and wherein said selecting comprises selecting a task that is most likely to generate an optimum schedule of tasks to be performed to complete said lithographic process, said

optimum schedule being one whose outcome has a maximum value of total quality, where total quality is the sum of the products of the values of each of said qualities and the respective weight factors.

11. A method according to claim 9, further comprising

receiving a plurality of weight factors for respective ones of a plurality of qualities affecting the outcome of said lithographic process; and

after all tasks necessary to complete a lithographic process have been scheduled, optimizing the schedule to maximize the value of total quality, where total quality is the sum of the products of the values of each of said qualities and the respective weight factors.

12. A method according to claim 11 wherein said optimizing comprises selecting at least one task in said schedule to be performed as late as possible.

13. A method according to claim 12 wherein the task selected to be performed as late as possible is a transport task.

14. A method according to claim 9 wherein, after all tasks necessary to complete a lithographic process have been scheduled, said determining, selecting, adding and detecting are repeated with at least one different selection being made to generate at least one second schedule; and further comprising

selecting from among said schedule and the at least one second schedule an optimum schedule; and

controlling said machine to perform said optimum schedule.

15. A method according to claim 9 wherein among the tasks performable by said machine are a first tied task and a second tied task;

in said determining of eligible tasks, said first tied task is determined to be eligible only if said second tied task is also determined to be eligible; and

if said first tied task is selected to be added to said schedule, said second tied task is automatically also selected for addition to said schedule.

16. A method according to claim 9 wherein said model of said machine includes a count of the number of materials present in a set of resources of the machine and a task that would add a material to the set of resources is ineligible if the addition of the material would increase said count above a predetermined threshold.

17. A method according to claim 9 wherein said machine includes at least one collision-hazardous area where there is a possibility of collisions between resources of the machine;

said model includes a virtual resource corresponding to the at least one collision-hazardous area;

when a task involving a resource entering or crossing the at least one collision-hazardous area is selected, the corresponding virtual resource is marked as occupied for the duration of said task and other tasks that involve a resource entering or crossing that collision-hazardous area are ineligible for selection while said virtual resource is marked as occupied.

18. A device manufacturing method comprising operating one or more tasks in a lithographic projection apparatus according to the method of claim 9 and projecting a patterned beam of radiation onto a target portion of a substrate.

19. A supervisory control system to operate a machine forming at least a part of a lithographic apparatus or a lithographic processing cell, the control system comprising:

an input device configured to receive a plurality of weight factors for respective ones of a plurality of qualities affecting the outcome of a lithographic process;

a scheduler configured to generate an optimum schedule of tasks to be performed to complete said lithographic process, said optimum schedule being one whose outcome has a maximum value of total quality, where total quality is the sum of the products of the values of each of said qualities and the respective weight factors.

20. A system according to claim 19 wherein said schedule specifies an order of tasks to be carried out by said machine and relative timings of at least some of said tasks.

21. A system according to claim 20 wherein said schedule further specifies at least one parameter for at least one task.

22. A system according to claim 19 wherein said weighting factors are defined for a lot of substrates.

23. A system according to claim 19 wherein said qualities are selected from the group comprising:

total post exposure delay time;

variation in post exposure delay time;

the number and/or type of alignment tasks to be carried out;

the degree of optimization of substrate conditioning;

the number, type and or timing of mask cleaning and inspection tasks;

the speed at which a scan is carried out; and

the degree of optimization of the exposure route.

24. A system according to claim 19 wherein said scheduler is configured to generate a plurality of schedules, calculate the total quality value for each generated schedule, and select from among said generated schedules the schedule having the highest total quality value as the optimum schedule.

25. A system according to claim 19 wherein said optimum schedule is based upon a model of the machine.

26. A lithographic apparatus comprising:

an illumination system configured to provide a beam of radiation;

a support structure configured to hold a patterning device, the patterning device serving to impart the beam with a pattern in its cross-section;

a substrate table configured to hold a substrate;

a projection system configured to project the patterned beam onto a target portion of the substrate; and

a control system according to claim 19.

27. A track unit comprising substrate handling devices and pre- and post- processing devices and a control system according to claim 19.

28. A lithographic processing cell comprising a lithographic apparatus, a track unit and a control system according to claim 19.

29. A computer program for controlling a machine forming at least a part of a lithographic apparatus or a lithographic processing cell, the program comprising program code that, when executed on a computer system, instructs the computer system to perform:

receiving a plurality of weight factors for respective ones of a plurality of qualities affecting the outcome of a lithographic process;

generating an optimum schedule of tasks to be performed to complete said lithographic process, said optimum schedule being one whose outcome has a maximum value of total quality, where total quality is the sum of the products of the values of each of said qualities and the respective weight factors.

30. A computer program according to claim 29 wherein said schedule specifies an order of tasks to be carried out by said machine and relative timings of at least some of said tasks.

31. A computer program according to claim 30 wherein said schedule further specifies at least one parameter for at least one task.

32. A computer program according to claim 29 wherein said weighting factors are defined for a lot of substrates.

33. A computer program according to claim 29 wherein said qualities are selected from the group comprising:

total post exposure delay time;

variation in post exposure delay time;

the number and/or type of alignment tasks to be carried out;

the degree of optimization of substrate conditioning;

the number, type and or timing of mask cleaning and inspection tasks;

the speed at which a scan is carried out; and

the degree of optimization of the exposure route.

34. A computer program according to claim 29 wherein said program code that, when executed on a computer system, instructs the computer system to perform generating of an optimum schedule comprises program code that, when executed on a computer system, instructs the computer system to perform:

generating a plurality of schedules;

calculating the total quality value for each generated schedule; and

selecting from among said generated schedules the schedule having the highest total quality value.

35. A computer program according to claim 29 wherein said generation of the optimum schedule is based upon a model of the machine.